Plastics: An Energy-Efficient Choice

Introduction

Plastics are derived from petroleum and natural gas. With increased public awareness and concern about waste and energy issues, some have questioned whether plastics are an efficient use of limited energy resources. But would energy be conserved if plastic packaging, for example, were replaced by non-plastic alternative?

Franklin Associates, Ltd., an independent research organization, recently conducted an in-depth analysis of the issue. They calculated the total energy used in producing common plastic packaging and disposable goods - from raw material extraction to delivery of the usable product - and compared it to the energy use of the most common non-plastic alternatives.

Their findings? The energy used to produce plastic packaging is considerably less than the energy needed to produce alternative packaging with other materials. The energy required to manufacture plastic disposable goods is comparable to, or less than, the energy used to produce non-plastic disposable goods.

Resins and Alternative Materials in Disposable Products

Packaging Type	Resins Used	Alternative Materials
Trash bags	HDPE, LLDPE	Reusable galvanized steel, unbleached kraft paper
Nonwovens	LDPE	Reusable cotton cloth, bleached kraft paper
Tumblers and glasses	PS	Reusable glass, coated bleached paperboard
Flatware and cutlery	PS	Reusable stainless steel, wood
Dishes, plates, bowls	PS	Virgin molded pulp, coated bleached paperboard
Wending and portion cups and lids	PS	Coated bleached paperboard, waxed coated paperboard

Foam cups, plates, containers	PS	Virgin molded pulp, coated bleached paperboard, coated waxed paperboard
Drinking straws	PP	Waxed paper

Resins and Alternative Materials in Disposable Products

Packaging Type	Resins Used	Alternative Materials
Blow molded	HDPE, LDPE, LLDPE, PET, PS, PVC	Steel, glass, refillable glass, coated bleached paperboard, 5% recycled aluminum, 61% recycled aluminum, recycled molded pulp, bleached kraft paper
Injected molded	HDPE, LLDPE, PET, PS, PP, PVC	Steel, corrugated wood, glass, refillable glass, 5% and 61% recyclable aluminum, coated bleached paperboard, recycled molded pulp, bleached kraft paper
Film	HDPE, LDPE, LLDPE, PD, PP, PVC	Bleached kraft paper, unbleached kraft paper, tissue, cellophane, wax, wax paper, paper/aluminum foil, 5% recycled aluminum, bleached and unbleached coated paper and paperboard, corrugated, steel
Sheet (1)	PET, PS, PVC	Steel, glass, cellophane, bleached kraft paper, coated bleached paperboard
Coating	HDPE, LDPE, LLDPE, PP	Wax
Thermoformed	PET, PS, PP	Coated bleached paperboard, steel, glass
PS foam (2)	PS	Virgin and recycled molded pulp, coated bleached paperboard, corrugated, wood, popcorn, unbleached paperboard

(1) Thick film extrusion products, includes calendered PVC.
(2) Extruded and thermoformed.

Methodology

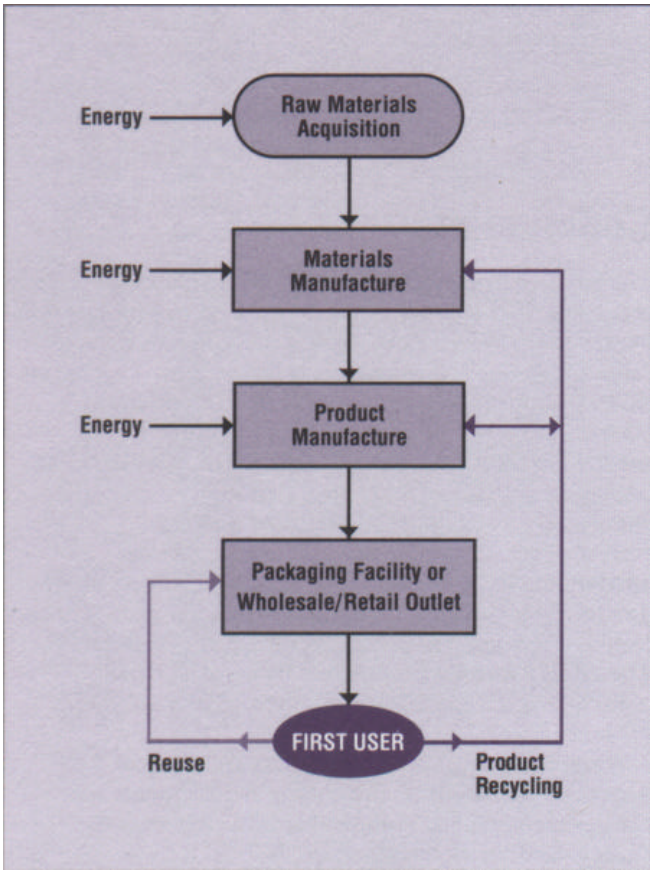
Comparing apples to apples

To develop a meaningful comparison, Franklin Associates had to define (a) the most logical alternative for each plastic product studied and (b) how much alternative material would be required to fulfill the same function as the plastic product. The latter

was expressed as a weight ratio - the average weight of the alternative product over the average weight of the plastic product.

Quantifying total energy use

Total energy use includes the energy requirements at each stage in the manufacturing process, from the extraction of raw materials to the delivery of the finished product to a packaging facility or, in the case of disposal, retail or wholesale outlet. The energy used to move materials from one step in the manufacturing process to the next ix also included.



The energy value of the natural gas and petroleum feedstocks used in manufacturing wax and plastics (raw materials principally used as fuel) is counted toward the total energy use for wax-coated and plastic items.

In some cases, reusable goods were among the alternatives to disposable plastic items. For example, glass tumblers are a reasonable alternative to disposable plastic cups. The energy required to prepare such items for reuse (shipping, cleaning, etc.) was factored into their total energy use. Energy impacts of recycling (at 1990 rates) also were included.

Also, some of the manufacturing process studied yield marketable by-products. Energy inputs were therefore adjusted to reflect the portion attributable to the packaging or disposable item in question.

Results

In 1990, 336 million fewer Btu were required to produce plastic packaging than would have been required to produce the non-plastic alternatives; 39 trillion fewer Btu were required to produce plastic disposable goods.

Energy Comparison Between Plastics and Alternatives in Packaging, 1990

Packaging Type	Energy Difference (1) (trillion Btu)
Blow molded	52.8
Injected molded	12.7
Film	262.3
Sheet (2)	8.5
Coating	(4.6)
Thermoformed	2.0
PS foam	2.7
Total Packaging	336.4

(1) Energy for alternatives minus energy for plastics. Numbers in parentheses indicate that the plastic products required more energy than the alternatives.
(2) Thick film extrusion products, includes calendar PVC.
(3) Extruded and thermoformed.
Source: Franklin Associates, Ltd.

Energy Comparison Between Plastics and Alternatives in Disposable Products, 1990

Packaging Type	Energy Difference (1) (trillion Btu)
Trash bags	19.4
Nonwovens	0.1
Tumblers and glasses	(0.8)
Flatware and cutlery	(4.9)
Dishes, plates, bowls	0.5
Vending and portion cups and lids	14.6
Foam cups, plates, containers	11.1
Drinking straws	(0.7)
Total Didposables	39.4

(1) Energy for alternatives minus energy for plastics. Numbers in parentheses indicate that the plastic products required more energy than the alternatives. Numbers may not add to total due to rounding.
Source: Franklin Associates, Ltd.

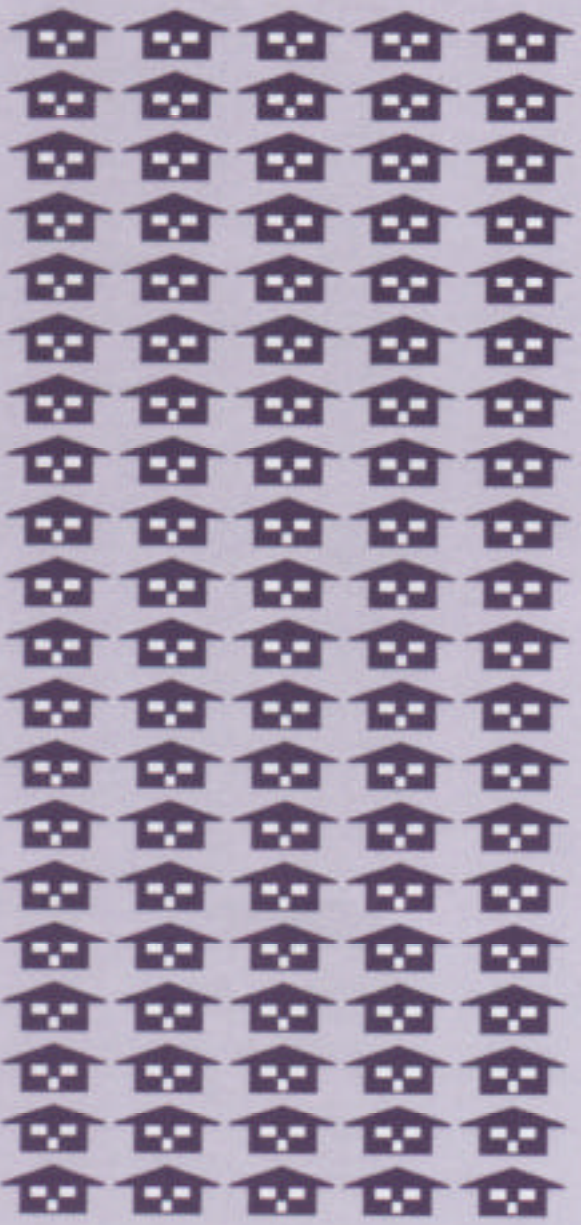
Conclusions

The total energy used in manufacturing plastic packaging is considerably less than the energy used to produce non-plastic alternatives - even when the inherent energy values of plastics' raw materials are factored in. This means that without plastic, the equivalent to an additional 58 million barrels of oil or 325 billion cubic feet of natural gas would have been required to meet America's packaging needs in 1990. That's enough to meet the energy needs of 100,000 homes for 35 years.

In the case of disposals, the energy savings are less dramatic. This is largely due to the inclusion of reusable items such as cutlery and tumblers among the alternatives of plastic disposables. The energy savings attributable to the reuse of these items outweigh the energy required to prepare them for reuse.

When disposable plastic products are compared to disposable alternatives, the energy requirements for plastics are generally comparable to or less than the energy used for alternatives.

In 1990 alone, the use of plastics versus alternative materials in packaging and disposable goods saved enough energy to power 100,000 homes for 35 years.



X 35 YEARS

= 1,000 homes